I YEAR
I SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATRIX METHODS IN STRUCTURAL ANALYSIS

Course Code: GR22D5001 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Engineering Mechanics, Strength of Materials, Structural Analysis

Course Objectives:

1. To learn how to idealize statically and kinematically determinate and indeterminate Structures and their ill effects.
2. To learn the difference between local and global co-ordinates systems and its role in preparation of stiffness matrix.
3. To understand the effective usage of flexibility matrix method in statically indeterminate structures.
4. To understand the effective usage of stiffness matrix method in kinematically indeterminate structures.
5. To understand about static condensation and sub structuring. To learn about shear walls and their role in multi storied structures.

Course Outcomes:

1. Evaluate the static and kinematic indeterminacy and generate stiffness and flexibility matrices.
2. Analyse the skeleton structures using stiffness method under different coordinate system.
3. Use flexibility matrix method to analyse different structures.
4. Use stiffness matrix method to analyse different structures.
5. Analyse various types of structural members using special analysis procedures and shear walls in multi storied constructions.

UNIT I

Introduction to matrix methods of analysis - Static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT II

Stiffness Matrix Assembly of Structures and its Applications to Simple Problems: Direct Stiffness method, Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations.

UNIT III

Analysis of Beams, Plane Trusses, Plane Rigid Jointed frames using flexibility metho

UNIT IV

Analysis of plane truss - continuous beam - plane frame and grids by stiffness matrix methods.

UNIT V

Special analysis procedures - Static condensation and sub structuring - initial and thermal stresses. Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

Text Books:

1. William Weaver J.R and James M. Geve, Matrix Analysis of Frames structures, CBS Publications, Delhi 2018.
2. Ashok.K.Jain, Advanced Structural Analysis, Nem Chand & Bros, Third Edition,2015.
3. C.S.Reddy, Basic Structural Analysis, Third edition, 2018.

Reference Books:

1. Kanchi, Matrix Structural Analysis, 1995.
2. J.Meek, Matrix Methods of Structural Analysis, 3rd edition, 1980.
3. Ghali and Neyveli, Structural Analysis-A unified Classical and Matrix approach,7th edition,2018.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED SOLID MECHANICS

Course Code: GR22D5002 **L/T/P/C: 3/0/0/3**
I Year I Semester

Course Prerequisites: Mathematics and Strength of Materials

Course objectives:

1. To explain the theory, concepts and principles of Elasticity
2. To generalize the equations of elasticity for two-dimensional problems of elasticity in terms of Cartesian and polar coordinates.
3. To demonstrate the equations of elasticity for two-dimensional problems of elasticity in terms of Cartesian and polar coordinates
4. To apply principles of elasticity to analyze the torsion and bending in prismatic bars
5. To extend the principles of stress/strain for plastic deformation to study the modes of failure

Course Outcomes:

1. Have a good understanding of the theory, concepts, principles and governing equations of Elasticity principles.
2. Develop equations of equilibrium and draw relations among stress, strain and displacement and utilize the equilibrium equations, compatibility equations and various boundary conditions to analyze elastic problems.
3. Gain the understating of three-dimensional problems of elasticity in Cartesian coordinates system ad able to determine principal stresses and planes of 3D problems.
4. Apply the principles of elasticity to solve torsional problems in prismatic bars andtubes.
5. Use the concepts of stresses and strains for plastic deformation to comprehend the yield criteria of materials.

UNIT I

Introduction to Elasticity: Notation for forces and stresses - Components of stresses - Components of strain – Hooke's law, Strain and Stress Fields, Stress and strain at a Point, Stress Components on an Arbitrary Plane, Hydrostatic and Deviatoric Components, Saint-Venant's principle.

UNIT II

Equations of Elasticity in Two-dimensional problems in rectangular and polar coordinates: Equations of Equilibrium, Stress- Strain relations, Strain –Displacement and Compatibility Relations, Boundary conditions, Plane stress and plane strain analysis - stress function -Two dimensional problems in rectangular coordinates - solution by polynomials.

UNIT III

Analysis of stress and strain in three dimensions in rectangular and polar coordinates - principal stresses - stress ellipsoid-determination of principal stresses - max shear stresses-equations of equilibrium in terms of displacements.

UNIT IV

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, use of soap films in solving torsion problems, Bending of Prismatic Bars: Stress function - bending of cantilever – circular cross section.

UNIT V

Concepts of plasticity, Plastic Deformation, Strain Hardening, Idealized Stress- Strain curve, Yield Criterions, Plastic Stress-Strain Relations.

Text Books:

1. Theory of Elasticity, S.P. Timoshenko and J.N. Goodier, Tata McGraw Hill, 3rd edition, 2017.
2. Advanced Mechanics of Solids, Srinath L.S., Tata McGraw Hill, 2nd edition, 2010.
3. Theory of Elasticity and Plasticity, H. Jane Helena, PHI Learning, 2017

Reference Books:

1. Theory of Elasticity, Sadhu Singh, Khanna Publishers, 2007.
2. Computational Elasticity, Ameen M., Narosa, 2005.
3. Solid Mechanics, Kazimi S. M. A., Tata McGraw Hill,2nd edition,2017.
4. Elasticity, Sadd M.H., Elsevier,3rd edition, 2014.
5. Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press,first edition,1998.
6. Theory of Plasticity, J. Chakrabarty, Butterworth-Heinemann publications,3rd edition, 2006.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY AND APPLICATION OF CEMENT COMPOSITES
(Professional Elective I)

Course Code: GR22D5003 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Concrete Technology

Course Objectives:

1. Characterization of composite materials
2. Analyse the mechanical behaviour of cement composites
3. Study on various types cement composites
4. Analyse the mechanical properties of cement composites
5. Study on the applications of Cement Composites

Course Outcomes:

1. Formulate constitutive behaviour of composite materials – Ferrocement, SIFCON and Fibre Reinforced Concrete - by understanding their strain- stress behaviour.
2. Classify the materials as per orthotropic and anisotropic behaviour.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse and design structural elements made of cement composites.
5. Apply the cement composites in various structures

UNIT I

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT II

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations,
Comparison of approaches to Stiffness.

UNIT III

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials And their Properties, Construction Techniques for Fibre Reinforced Concrete – Ferro cement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT IV

Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

UNIT V

Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and

Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants. Analysis and Design of Cement Composite Structural Elements – Ferro cement, SIFCON and Fibre Reinforced Concrete.

Text books

1. Engineering Mechanics of Composite Materials, Isaac M. Daniel , Ori Ishai , Publisher : OUP USA; 2nd edition,2005.
2. Advanced mechanics of materials, Roman Solecki; R. Jay Conant, Oxford University Press, USA, 2003
3. Ferrocement--- B R Paul and R P Pama. Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand 2015.

Reference books

1. Fibre Reinforced Cement Composites, P. N. Balaguru and S P Shah, Mc Graw Hill, 2010.
2. Mechanics of Composite Materials, Jones R.M,, 2nd Ed., Taylor and Francis, BSP Books,1998.
3. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.
4. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman &Hall, 1983.
5. Taylor H.F.W, Cement Chemistry, Thomas telford, 2nd Edition, New York, 1997.
6. Fibre Reinforced Cementitious Composites- Arnon Bentur, Sidney Mindees, CRC Press, 1990.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED CONCRETE TECHNOLOGY
(Professional Elective I)

Course Code: GR22D5004 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisite: Concrete Technology

Course Objectives:

1. To study the physical and chemical properties of cement and admixtures. And also to know about hydration and SEM analysis.
2. To study the properties and conduct the tests on fresh and hardened concrete.
3. To acquire the practical knowledge on mix design principles, concepts and methods.
4. To get an adequate knowledge about the special concretes and their applications in the diverseconstruction field.
5. To design the forms of different materials for the different types of works under different conditions.

Course Outcomes:

1. List out the types of cement, admixture and decide the suitable cement and admixture for specific purpose.
2. Determine the properties of concrete ingredients i.e. cement, fine aggregate and coarse aggregate by conducting different tests such as work ability etc.,
3. Design the mix proportion of ordinary, standard and high strength concrete by using different methods and how the strength of concrete can be modified by changing the proportions.
4. Decide suitable concrete for different structures considering the prevailing weathering conditions and Design economic concrete mix proportion for different exposure conditions and intended purposes with special concrete.
5. Design the forms for a specific work and decide the time of removal of forms for the different elements in different situations.

UNIT I

Concrete Making Materials: Cement- Bogues compounds – Hydration Process – Alkali silica reaction - Admixtures – Chemical and Mineral admixtures. The chemistry of Portland cement manufacture-Hydration of calcium silicate phases-Hydrated aluminates, ferrite and sulphate phases

UNIT II

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete - Segregation and bleeding. Hardened Concrete: Abram's law- Gel space ratios, Maturity Concept–Stress Behavior– Creep and Shrinkage–Durability tests on concrete- Nondestructive testing of concrete.Microstructure and properties of hardened concrete-Microstructure of concrete- Strength

UNIT III

High Strength Concrete –Use of Nano materials – Manufacturing and Properties- Design of HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete. High Performance Concrete - Requirements and properties of High-Performance Concrete.

UNIT IV

Special Concretes: Self Compacting concrete – Mix design of SCC by Nansu method – Polymer concrete – Fiber reinforced concrete– Reactive Powder concrete – Geopolymer Concrete - Requirements and Guidelines – Advantages and Applications. Light weight concrete, Bacterial concrete.

Concrete mix design: Mix Design method - BIS method, ACI method, DOE method.

UNIT V

Form work for Concrete – materials – structural requirements – form work systems – connections – specifications – slip forms, permanent form work, latest form work– design of form work – shores – removal of forms – reshoring – failure of form work-case studies.

Text Books:

1. A.M.Neville, Properties of Concrete, Pearson publications, 5th edition,2011.
2. P Kumar Mehta, Paulo J M Monteiro, "Concrete: Microstructure, Properties, and Materials", 4thedition McGraw Hill Education; 2017
3. M.S.Shetty, Concrete Technology, S.Chand& Co publications,2006.

Reference Books:

1. A.R. Santhakumar, Concrete Technology, Oxford Press,2006.
2. Rafat Siddique, Special Structure concretes, Galgotia Publications, 3rd edition,2000.
3. N.KrishnaRaju, Design of Concrete Mixes, CBS Publications,5th edition,2017.
4. P.K.Mehta, Concrete: Micro Structure,properties and materials, ICI, Chennai,4th edition, 2014.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY OF STRUCTURAL STABILITY
(Professional Elective I)

Course Code: GR22D5005 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Strength of Materials, Structural Analysis

Course Objectives:

1. To impart basics in the theory of structural stability of discrete and continuous Systems.
2. To analyze for stability of columns with axial, flexural, torsional, combined buckling and with and without lateral bracing.
3. To analyze for stability of member buckling and global buckling in frames.
4. To analyze the lateral torsion buckling in beams and the axial flexural buckling, shear flexural buckling, buckling under combined loads in plates.
5. To explain the concepts of inelastic buckling and dynamic stability.

Course Outcomes:

1. Comprehend the basics in the theory of structural stability of discrete and continuous Systems.
2. Analyze for stability of columns with axial, flexural, torsional and combined buckling and also investigate for stability of columns with lateral bracing.
3. Evaluate for stability of member buckling and global buckling in frames.
4. Analyze the lateral torsion buckling in beams and for the axial flexural buckling, shear flexural buckling, buckling under combined loads in plates.
5. Explain the concepts of inelastic buckling and dynamic stability.

UNIT I

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

UNIT II

Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT III

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT IV

Stability of Beams: lateral torsion buckling. Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT V

Introduction to Inelastic Buckling and Dynamic Stability.

Text Books:

1. WIGGERS S L, Structural Stability And Vibration by , SPRINGER, 2018
2. A.I. Rusakov , Fundamentals of Structural Mechanics Dynamics and Stability, Taylor & Francis, 2020
3. Theory of elastic stability, Timoshenko and Gere, Dover publications,2nd edition,2009.

Reference Books:

1. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey,1974.
2. Structural Stability of columns and plates, Iyengar, N. G. R., Ellis Horwood Ltd publisher, 1988.
3. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York, 1952.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING
(Professional Elective II)

Course Code: GR22D5006 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Fundamentals of Matrices, Mathematics

Course Objectives:

1. To analyse the performance of various interpolation technique and perform error analysis.
2. To develop the skill of solving linear algebraic systems by direct and iteration methods.
3. To compare various numerical differentiation and integration techniques.
4. To explain the various techniques to study Initial value problems in Ordinary Differential Equations.
5. To solve a range of problems on applicable software.

Course Outcomes:

1. Apply numerical methods to find the roots of a Nonlinear Algebraic and Transcendental equations and perform error analysis.
2. Solve linear algebraic system by direct and iteration methods and apply the knowledge of Eigen values and Eigen vectors to some contents in engineering.
3. Apply the knowledge of interpolation and extrapolation of uniform and non-uniform data to certain contents of Civil Engineering.
4. Apply the knowledge of numerical differentiation and integration to some contents of Civil Engineering.
5. Formulate simple problems into programming models.

UNIT I

Solution of Nonlinear Algebraic and Transcendental Equations:

Bisection Method; Fixed-Point Iteration Method; Secant Method; Newton Method; Rate of Convergences; Solution of a System of Nonlinear Equations; Unconstrained Optimization.

Error Analysis: Floating-Point Approximation of a Number; Loss of Significance and Error Propagation; Stability in Numerical Computation.

UNIT II

Elements of Matrix Algebra: Solution of Systems of Linear Equations-Direct method – Cramer's rule, Guass – Elimination Method-Gauss Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods -Jacobi – Iteration method – Gauss – Siedel iteration, Eigen Value Problems- Jacobi method for symmetric matrices- Power method

UNIT III

Fundamentals of Numerical Methods: Linear Interpolation - Higher Order Interpolation - Lagrange Interpolation Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Curve Fitting: Fitting a straight-line, Second-degree curve, Exponential curve, power curve by method of least squares.

UNIT IV

Numerical Differentiation & Integration: Solution of Ordinary and Partial Differential Equations - Numerical Integration – Double integration using Trapezoidal and Simpson's method. Euler's method – Backward Euler method – Midpoint method – single step method- Taylor's series method- R-K Methods. Boundary value problems. Finite Difference Schemes.

UNIT V

Computer Algorithms: Algorithms – developing an algorithm for simple mathematical problems. Introduction to Fuzzy Logic and Neural Networks - applications in Civil and Structural Engineering.

Text Books:

1. An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons,2nd edition 1989.
2. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988.
3. An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons,2nd edition 1989

Reference Books:

1. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (ShaumSeries), 1988.
2. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 4th edition 2005.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL HEALTH MONITORING
(Professional Elective II)

Course Code: GR22D5007 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Structural Vibrations, Advanced Solid Mechanics, Engineering physics, concrete technology.

Course Objectives:

1. To make the student to understand the Health of the structure.
2. To train the student to diagonise the distress due to various causes & Faults and identify the distress for documentation.
3. To prepare the student to assess the health of structure using static field methods.
4. To prepare the student to assess the health of structure using dynamic field tests.
5. To motivate the student to suggest Repairs, Rehabilitation & Retrofitting of the structure.

Course Outcomes:

1. Understand the Health of the structure.
2. Diagonise the distress due to various causes & Faults.
3. Identify the distress and document.
4. Assess the health of structure using static & dynamic field methods.
5. Suggest Repairs, Rehabilitation & Retrofitting of the structure.

UNIT I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance. Structural Health Monitoring: Concepts, Various Measures.

UNIT II

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Structural Health Monitoring techniques: RF/PSTN/GSM/Satellite Communications, Networking of sensor, Data compression technique, Case Studies.

UNIT III

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, Static Response Measurement.

UNIT IV

Dynamic Field Testing: Types of Dynamic Field Test, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT V

Introduction to Repairs and Rehabilitations of Structures: piezo–electric materials and other smart materials electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Text Books:

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, Structural Health Monitoring, Wiley publishers ISTE 2nd Edition 2010
2. Duglas E Adams, Health Monitoring of Structural Materials and Components-Methods with Applications, John Wiley and Sons, 2007.
3. Structural Health Monitoring, Daniel Balageas, Claus_Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006

Reference Books:

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic PressInc,2007

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL OPTIMIZATION
(Professional elective II)

Course Code: GR22D5008 **L/T/P/C: 3/0/0/3**
I Year I Semester

Prerequisites: Differential equations and Vector calculus, Engineering mathematics.

Course Objectives:

1. To introduce the concepts of different variables and constraints with classical optimizationtechniques
2. To understand the formulation of structural optimization problems in linear programming problem.
3. To get familiarized with the application of non-linear programming to structural optimizationtechniques.
4. Understand the dynamic programming, decision theory and simulations.
5. Apply optimization techniques for simple optimal design of trusses, frames and reinforced concrete framed structures.

Course Outcomes:

1. To understand the techniques and theories in structural optimization methods.
2. To determine the linear programming problems by different phases of simplex method.
3. To analyse the different methods of constrained and unconstrained optimization techniques.
4. To comprehend the concepts of multistage decision processes of Dynamic programming.
5. To formulate the optimal design of trusses, frames and reinforced concrete framed structures.

UNIT I

Introduction: Design Variables, objective function, constraints, statement of an optimization problem, problem formulation for optimization techniques.

Classical Optimization Techniques: Single Variable optimization, multivariable optimization with no constraints, with equality and inequality constraints**.**

UNIT II

Linear Programming: Standard form of linear programming problem, simplex method, pivotal reduction of general systems of equations, simplex algorithm, two phase simplex method.

UNIT III

Non-Linear Programming: Unconstrained optimization techniques - Descent methods, gradient of function, steepest descent method, variable metric method (Deviation-Fletcher-Powell method)

Non-Linear Programming: Constrained optimization techniques: penalty function methods, sequential unconstrained minimization techniques, sequential linear programming.

UNIT IV

Dynamic Programming: Multistage decision processes, concept of sub optimization and principle of optimality computational procedure.

UNIT V

Optimization of Structures: Formulation of constraints and objective function for structural design problems, optimal design of trusses, frames and reinforced concrete framed structures, structural optimization using computer programs like MAT lab, C and C++ .

Text Books:

1. Sastry S.S."Introductory Methods of Numerical Analysis", Prentice Hall of India, 2012.
2. Rao S.S., "Engineering Optimization-Theory and Applications", New Age International Publishers,1984.
3. Singiresu S. Rao,("Engineering Optimization (Theory and Practice)"New Age International (P) Ltd, 3rd edition, 2010.

Reference Books:

1. Rao, S.S., Optimization: Theory and Applications, Halsted Press, USA,1984
2. Kirsch, U., Structural Optimization, Springer-Verlag, Berlin,1993.
3. Bhavikatti, S.S., Structural Optimisation Using Sequential Linear Programming, Vikas Publishing House Pvt. Ltd., New Delhi,2003

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL DESIGN LAB

Course Code: GR22D5009 **L/T/P/C: 0/0/4/2**

I Year I Semester

Prerequisites: Design of Reinforced Concrete Structures, Structural Analysis, Foundation Engineering

Course Objectives:

1. To learn the software applications in structural engineering.
2. To develop a template for designing of the reinforced concrete members.
3. To learn the analysis of plane, space truss and frames subjected to different types of loadings.
4. To study the static and dynamic analysis, design and detailing of RCC framed structural members.
5. To study the analysis and design of Steel truss members.

Course Outcomes:

1. Understand the software usages and produce structural drawing for structural members.
2. Analyse and design the plane frame and truss subjected to different type of loading.
3. Design and detailing of RC structural members like beam, column, slab, and Footing
4. Analysis and design of RCC framed structures statically for different loading conditions.
5. Analysis and design of RCC framed structures dynamically for different loading conditions

List of Experiments

1. Develop a template for design of one-way slab.
2. Develop a template for design of two-way Slab.
3. Develop a template for design of columns.
4. Develop a template for design of combined footing.
5. Analysis and design of continuous beam.
6. Analysis and design of plane frame.
7. Analysis of multi-storeyed space frame.
8. Static analysis of multi-storeyed structure.
9. Dynamic analysis of multi-storeyed structure.
10. Analysis and design of Steel truss.

Software: Relevant Software

References:

1. IS 456: 2000-Plain and Reinforced Concrete- Code of Practice.
2. IS 1893:2002-Criteria for Earthquake Resistant Design of Structures.
3. IS 875 part 3: 1987- Code of Practice for Wind loads.
4. IS 875 part 4:1987- Code of Practice for design loads (other than Earthquake) for building structures.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED CONCRETE TECHNOLOGY LAB

Course Code: GR22D5010 **L/T/P/C: 0/0/4/2**
I Year I Semester

Prerequisites: Concrete Technology Theory and Practical.

Course Objectives:

1. Familiarize the students with physical, chemical and mechanical properties of cement concrete constituents and understand the mix design of high-grade concrete.
2. Analyze the stress-strain curve of high strength concrete and develop correlation between cube and cylinder of high strength concrete.
3. Determine the mechanical properties of high strength concrete and knowledge on cyclic loading on steel.
4. To conduct Non-Destructive testing methods on existing concrete members and behaviour of beams under flexure.
5. To study the behaviour of self-compacting concrete and existing RC structures reinforcement details and corrosion levels.

Course Outcomes:

1. Design high grade concrete and identify, carry out laboratory tests related to the use of concrete on site.
2. Develop correlation between cube and cylinder of high strength concrete and analyze the stress-strain curve.
3. Interpret the mechanical properties of high strength concrete and examine the effect of cyclic loading on steel
4. Assess the quality of existing concrete members by Non-Destructive testing methods and study the behaviour of beams under flexure.
5. Analyze the behaviour of Self Compacting Concrete and understanding reinforcement details and corrosion levels in existing RC structures.

List of Experiments/Assignments:

1. Conduct basic tests on cement and aggregates.
2. Design the mix proportions for high strength concrete.
3. Study the stress-strain curve of high strength concrete.
4. Study the correlation between cube and cylinder of high strength concrete.
5. Determine the split tensile strength of high strength concrete
6. Determine the modulus of rupture of high strength concrete.
7. Determine the compressive strength of existing concrete members by Non-Destructive testing method.

8. Assess the quality of existing concrete members by Non-Destructive testing method.
9. Study the flow properties of self compacting concrete.
10. Evaluation of air content in concrete.
11. Optimization of dosage of super plasticizer in cement.
12. Demonstration on how to locate reinforcement details in any existing RC structures.
13. Demonstration on assessing the level of corrosion in the existing RC structures.

Reference Books:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co.,5th edition, 2006

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RESEARCH METHODOLOGY AND IPR

Course Code: GR22D5011 **L/T/P/C: 2/0/0/2**
I Year I Semester

Course Objectives:

1. To familiarize students with the different aspects of research.
2. To provide an idea of good scientific writing and proper presentation skills.
3. To provide an understanding of philosophical questions behind scientific research.
4. To provide a brief background on the historical legacy of science.
5. To provide an insight of nature of Intellectual Property and new developments in IPR.

Course Outcomes:

1. Understand research problem formulation and analyze research related information and follow research ethics.
2. Understand that today‘s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
3. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering.
4. Understand the nature of Intellectual Property and IPR in International scenario.
5. Understand that IPR protection provides an incentive to inventors for further and design the administration of patent system and new Developments in IPR.

UNIT I:

Research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Citation

UNIT III:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books and References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guidefor beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
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